VI.2 CORRELATION WITH EXPERIMENT - HOMOGENEOUS SOLUTIONS

Experimental data for homogeneously poisoned solutions is extremely scarce. Apparently only one set of very limited experiments have been made to date[1]. The following table shows the correlation using 18 group cross sections generated by GAMTEC II with the HFN diffusion theory code for critical experiments performed in bare aluminum spheres of 27.24 inches diameter.

Exp. No.	Solution	Fissile g/l	Boron g/l	Calculated k
1	93.18 Wt% ^{235}UNH	18.75	0	.9952
2		21.93	.0935	.9959
4		26.51	.230	.9953
5	97.74 Wt% ^{233}UNH	16.75	0	1.0070
7		18.10	.0465	1.0078
9		19.37	.0912	1.0075

Experiments 4 and 9 were calculated with no boron and k values of 1.1338 and 1.0777 respectively. This results in Δk changes of -0.60 and -0.77 for the addition of each gram per liter of boron. The calculations indicate that in experiment 7 the boron compensated for a Δk of 0.0465×0.77 or 0.0358. The Δk between the calculated k-effectives of experiments 5 and 7 is 0.0008. Since this was the worst case, the calculational error is thus a maximum of 2.2 percent (ignoring effects of the experimental error in determining the boron concentration) for this set of data. This accuracy would appear quite acceptable for calculating the effects of boron addition (and,by inference, the addition of other poison isotopes with cross section values of comparable accuracy).

The calculation of reactivities of unpoisoned solutions of greater fissile concentrations has been shown to be reliable. Thus the extrapolation of poisoned solutions critical parameters to higher fissile concentrations should also be reliable. However, the limited range of

the poison experiments requires that a conservative approach be taken to the use of such calculated parameters pending further experimental verification.

---

(1) R. Gwin and D. W. Magnuson, "The Measurement of Eta and Other Nuclear Properties of ^{233}U and ^{235}U in Critical Aqueous Solutions", Nuclear Science and Engineering, 12: 364-380, 1962.